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What Smokers Believe about Light and Ultralight Cigarettes[1]

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Objectives. **To assess the knowledge of smokers and ex-smokers about light cigarettes and nicotine yields and their perception of the risk of lung cancer, and to identify the characteristics of smokers of light cigarettes.**

Methods. **Mail survey in a population sample of 494 smokers and exsmokers in Geneva, Switzerland, in 1999.**

Results. **Participants were on average 40 years old, and 49% were men. They estimated that one would have to smoke two light cigarettes or four ultralight cigarettes in order to inhale the same amount of nicotine as that in one regular cigarette. Most participants (60%) answered that the risk of lung cancer was the same, but 27% answered that this risk was lower in smokers of light cigarettes than in smokers of regular cigarettes. The most frequent answer (41% of answers) to an open-ended question on the meaning of the number of milligrams of nicotine printed on cigarette packs was that this number indicated the nicotine content in cigarettes, rather than a machine-determined yield in smoke. In a multivariate model, smoking mild, light, or ultralight (vs regular) cigarettes was associated with females, a lower Fagerström dependence score, an intention to quit smoking, and an intention to decrease cigarette consumption.**

Conclusions. **Many smokers choose light cigarettes because they think that such cigarettes are safer or less addictive. The public should be further informed of the meaning and purpose of cigarette labels.**

Key Words: **smoking; health behavior; light cigarettes.**

INTRODUCTION

Over the previous decades, smokers have massively shifted from high-nicotine and high-tar cigarettes to lower yield brands [*1*]. One reason for that shift is that smokers may believe that cigarettes labeled as "low tar," "low nicotine," or "light" are less addictive and less harmful [*2–4*]. Because they believe that such cigarettes are safer, some people may have continued to smoke when they would otherwise have quit smoking. This belief may also have attracted nonsmokers who would not otherwise have begun to smoke [*3,5*].

Nicotine and tar numbers printed on cigarette packs represent nicotine or tar yields in smoke under artificial smoking conditions, not the content in cigarettes of nicotine and other compounds. All types of cigarettes contain between 6 and 17 mg of nicotine, and smokers derive about 1 to 2 mg of nicotine per cigarette, irrespective of nicotine yields in cigarette smoke [*6–8*]. Nicotine and tar yields are determined by smoking machines, a mechanism that does not reflect actual smoke intake by smokers [*8,9*]. The smoking-machine procedure still used today (a 35-mL puff of 2 s in duration every 60 s) was defined at a time when cigarettes were unfiltered and high in tar compared to current cigarettes [*9,10*]. This procedure fails to model the smokers' ability to obtain a level of nicotinemia that will prevent nicotine withdrawal symptoms [*11*]. Changing the parameters of smoking machines to bring them closer to the actual smoking behavior of smokers may increase nicotine yields up to 5-fold and tar yields up to 11-fold [*12,13*].

Recently disclosed tobacco industry documents show that the industry defeated the official smoking-machine tests by designing "elastic" cigarettes that give little nicotine to the machine and a lot to smokers [*9*]. Low-yield cigarettes are obtained by the addition of

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ventilation holes and the use of reconstituted tobacco, porous cigarette papers, and chemical additives [*1,14*]. However, smokers compensate by blocking ventilation holes and by modifying their inhalation patterns [*15*]. Deeper inhalation increases the delivery of carcinogens such as nitrosamines and polycyclic aromatic hydrocarbons to the peripheral lung [*16–18*]. Epidemiologic studies suggest that smoking low-tar cigarettes may even increase the risk of lung adenocarcinoma [*16,19*]. Thus, low-tar cigarettes may cause different forms of lung cancer, but not necessarily fewer cases [*19,20*]. Finally, smoking low-yield cigarettes does not reduce the risk of heart disease [*21–23*]. Thus, it is doubtful whether light cigarettes reduce the risk of disease or of becoming addicted to tobacco.

Many smokers are unaware of these facts. For instance, most smokers overestimate the number of light cigarettes necessary to equal the tar intake from one regular cigarette [*3,24*]. There is little published research on smokers' knowledge of nicotine yield numbers [*2,25*]. To clarify these issues, we conducted a study to assess the knowledge of smokers about nicotine yield numbers and about the risk of smoking light and ultralight cigarettes. This study also aimed to identify the characteristics of smokers of light and ultralight cigarettes.

METHODS

We conducted a mail survey in a random sample of 2,000 people aged 18–70 drawn from the official registry of residents of Geneva, Switzerland, in 1999. Nonrespondents received a reminder postcard and two reminder questionnaires. The questionnaire was aimed at current and former smokers. In order to increase participation, those who did not wish to participate were asked to transmit the questionnaire to an eligible acquaintance. Previous research had shown that this procedure had little impact on the distribution of participants by stage of change, on the level of addiction to cigarettes, and on associations between smoking-related variables [*26*].

Questionnaire Content

We asked the following questions:

"In your opinion, how many (a) light and (b) ultralight cigarettes would someone have to smoke to inhale the same amount of nicotine as from one regular cigarette?" (Open-ended responses.)

"In your opinion, what is the risk of lung cancer among smokers of (a) light and (b) ultralight cigarettes, compared to the risk in smokers of regular cigarettes?" Answers were given on scales with 11 response options: "A risk decreased by 90, 75, 50, 25, 10%; The same risk (*0*); A risk increased by 10, 25, 50, 75, 90%."

"What is the meaning of the number of mg of nicotine written on cigarette packs?" (Open-ended response; this question was asked of smokers only.)

"In general, what type of cigarettes do you smoke?" followed by five response options: "Regular or Full flavor; Mild; Light; Ultralight or Superlight; Hand-rolled."

In addition, the questionnaire covered age, sex, school years, number of cigarettes smoked per day, the Fagerström test for nicotine dependence [*27*], quit attempts in the previous year, perceived difficulty in quitting smoking, number of years as a daily smoker, occasional or daily smoking, intention to quit smoking (0–10 score), intention to decrease cigarette consumption (0–10 score), and the fear of getting lung cancer from smoking (1–5 score). Smokers were classified in three "stages of change" [*28*]: "precontemplation" (no intention to quit smoking in the next 6 months), "contemplation" (seriously considers quitting within the next 6 months), and "preparation" (had decided to quit in the next 30 days and made a quit attempt in the past year).

Cigarette Packs

Participants were asked to return one of their empty cigarette packs together with the baseline questionnaire. In Switzerland, the indication of nicotine and tar yields on cigarette packs is mandatory; this information is provided by the manufacturers. We examined the nicotine and tar numbers on these packs, as well as the presence of labels such as mild, light, ultralight, or superlight.

Comparison with a Population Sample

To assess how we could generalize our results, we compared smokers in this survey with smokers in a representative sample of the population of Geneva [*29*]. The latter survey was conducted by mail in a random sample of 1,000 people aged 18–70 drawn from the official registry of residents of Geneva, Switzerland, in 1996. Nonrespondents received up to four reminder questionnaires.

Statistical Analyses

We used ANOVA and t tests to compare continuous variables and χ^2 tests to compare categorical variables. We used a multivariate logistic regression model to identify variables associated with smoking mild, light, or ultralight vs regular cigarettes.

RESULTS

Participation

The survey yielded 494 questionnaires (25% of 2,000) from a population that included about 50% people who had ever smoked [*29*]. We received answers from 323

TABLE 1

Characteristics of Smokers of Regular, Mild, Light, Ultralight, and Hand-Rolled Cigarettes in a Population Sample in Geneva, Switzerland, 1999

	Missing answers (%)	All smokers	Regular	Mild	Light	Ultralight	Hand-rolled	*P* value
Number of participants	—	386	87	58	127	84	10	—
Men (%)	0.5	49	58	55	43	39	70	0.04
Age[a]	2.3	39	41	35	39	39	43	0.03
School years[a]	4.9	14	14	14	15	15	17	0.2
Number of years as a daily smoker[a]	6.7	19	22	15	18	17	24	0.002
Cigarettes per day[a]	5.7	18	22	15	17	17	14	0.003
Minutes to first cigarette[a]	10.4	91	69	85	95	107	83	0.4
Fagerström test for nicotine dependence[a]	4.9	3.2	4.2	2.9	3.1	2.9	2.5	0.001
Difficult to quit smoking (score, 0–10)[a]	6.5	5.9	6.7	5.4	5.8	5.7	6.3	0.03
Made a quit attempt in past year (%)	6.7	43	31	57	45	59	30	0.001
Occasional smokers (%)	0	16	7	17	16	14	10	0.3
Intention to quit smoking (score, 0–10)[a]	5.2	4.7	3.6	4.7	5.5	4.6	1.8	0.001
Intention to decrease number of cigarettes/day (score, 0–10)[a]	8.0	5.2	4.1	4.8	6.1	5.4	4.4	0.001
"I am afraid that smoking will give me lung cancer" (score 1–5)[a]	6.5	2.3	2.0	2.1	2.5	2.4	2.9	0.002

[a] Means.

daily smokers, 63 occasional (nondaily) smokers, and 105 exsmokers. Participants were on average 40 years old, and 243 (49%) were men. Daily smokers smoked on average 20 cigarettes per day, occasional smokers, 4 cigarettes/day (mean for the whole sample: 18 cigarettes/day). Sixty percent of smokers were in the precontemplation stage of change, 36% were in the contemplation stage, and 5% were in the preparation stage. Among smokers, 23% smoked regular cigarettes, 15% mild cigarettes, 33% light cigarettes, 22% ultralight or superlight cigarettes, and 3% hand-rolled cigarettes (Table 1). Empty cigarette packs were returned by 214 smokers (55%).

The population survey yielded a 74% response rate ($n = 742$). We retained only the 203 current smokers in this sample for comparison with the survey on light cigarettes.

Comparison with a Representative Sample

Comparing smokers in this survey to smokers in a representative population sample of smokers, we found no statistically significant differences in age, number of years as a smoker, or level of tobacco dependence (assessed with the number of cigarettes smoked per day and the time to the first cigarette in the morning) (Table 2). However, smokers in the survey on light cigarettes were slightly more educated (one more year of school) and they were more motivated to quit smoking (more of them were in the contemplation stage of change).

Opinions on Light Cigarettes

Participants answered that a smoker would have to smoke a median of two light cigarettes (25th and 75th percentiles, two and three cigarettes) or four ultralight cigarettes (25th and 75th percentiles, three and six cigarettes) in order to inhale the same amount of nicotine as that from one regular cigarette. Twelve percent of participants answered that one would have to smoke one light cigarette, and 9% one ultralight cigarette, in order to inhale the same amount of nicotine as that from one regular cigarette. The question on light cigarettes was left unanswered by 24% of participants and the question on ultralight cigarettes by 27% of participants.

Twenty-seven percent of participants answered that the risk of lung cancer was lower in smokers of light cigarettes than in smokers of regular cigarettes, 60% that the risk was the same, and 7% that the risk was

TABLE 2

Comparison of Current Smokers in the Survey on Light Cigarettes to Current Smokers in a Representative Sample of the Population in Geneva [29]

	Population sample	Survey on light cigarettes	*P* value
Number of participants	203	386	—
Men (%)	56	49	0.04
Age	38	39	0.83
School years	13	14	< 0.001
Cigarettes per day	17	18	0.20
Smoke their first cigarette within 5 min of waking up (%)	10	13	0.49
Number of years as a smoker	18	19	0.47
Stages of change (%)			
Precontemplation	74	60	0.00
Contemplation	22	36	—
Preparation	4	5	—

TABLE 3

Multivariate Analysis of Variables Associated with the Type of Cigarettes Smoked

	Odds ratio of smoking mild, light, or ultralight vs regular cigarettes	95% confidence interval	*P* value
Sex (women vs men)	1.76	1.03, 3.01	0.04
Fagerström dependence test (per point on a scale of 0–10)	0.80	0.72, 0.88	<0.001
Intention to quit smoking (per point on a scale of 0–10)	1.12	1.02, 1.22	0.02
Intention to decrease daily cigarette consumption (per point on a scale of 0–10)	1.11	1.02, 1.21	0.01

higher; 7% gave no answer. For ultralight cigarettes, the corresponding figures were 32, 55, 6, and 7%. There was no effect of age and sex on the perceived risk and nicotine content of light and ultralight cigarettes. There was no statistically significant difference in the answers to these questions among smokers of regular, mild, light, and ultralight cigarettes.

Meaning of Nicotine Yield

The open-ended question on the meaning of the number of milligrams of nicotine printed on cigarette packs was answered by 288 people (75% of smokers). The most frequent answer was that this number indicated the quantity of nicotine in one cigarette or the content of nicotine in one cigarette or in one pack of cigarettes (118 responses, 41% of answers). Nineteen people (7% of answers) answered that this number indicated the quantity of nicotine inhaled from one cigarette, and one person answered that this number indicated the number of milligrams of nicotine in the smoke of one cigarette; 89 people (31%) did not know and another 61 (21%) gave various other answers. Thus, over half the smokers either gave no answer to this question or answered that they did not know.

Characteristics of Smokers of Light Cigarettes

Women were more likely than men to smoke light or ultralight cigarettes (Table 1). Smokers of mild cigarettes were on average 6 years younger than smokers of regular cigarettes. Among smokers <20 years old, twice as many people smoked mild (35%) as smoked regular cigarettes (17%), but among smokers >30 years old, twice as many people smoked regular (28%) as smoked mild cigarettes (12%). Smokers of mild, light, or ultralight cigarettes smoked >5 cigarettes less per day than smokers of regular cigarettes, scored lower on the Fagerström dependence test, had smoked for fewer years, were more motivated to quit smoking, were more likely to say that quitting would be easy, were more likely to have attempted to quit smoking in the previous year, and were more likely to be occasional smokers. Compared to smokers of regular cigarettes, smokers of light and ultralight cigarettes were more motivated to decrease their cigarette consumption and were more afraid of getting lung cancer.

In a multivariate model, only the following variables remained independently associated with smoking mild, light, or ultralight (vs regular) cigarettes: sex, Fagerström dependence score, intent to quit smoking, and intent to decrease cigarette consumption (Table 3).

Cigarette Packs

Cigarette packs provided by participants indicated that the nicotine and tar yields varied widely *within* types of cigarettes (regular, mild, light, or ultra/superlight) (Table 4). Consequently, there was a considerable overlap in the nicotine and tar yields between types of cigarettes. Ten percent of packs had nicotine yields <0.1 mg; 61% had yields <0.5 mg; 65% had yields <0.6 mg, and 92% had yields <0.9 mg.

DISCUSSION

This study reveals serious deficiencies in the knowledge of smokers and exsmokers about light and ultralight cigarettes. Participants thought that one would need to smoke two light cigarettes or four ultralight cigarettes in order to inhale the same amount of nicotine as that from one regular cigarette. Only one in ten participants answered that one inhaled the same amount of nicotine from regular, light, or ultralight cigarettes. These results are very close to the perceptions of United States population samples surveyed in 1996 and 1999 on tar intake from regular, light, or ultralight cigarettes [*3,24*].

The most frequent interpretation of the nicotine numbers written on cigarette packs was that these numbers described the nicotine content in cigarettes,

TABLE 4

Number of Milligrams of Tar and Nicotine Printed on Cigarette Packs Provided by 214 Smokers in a Population Sample, Geneva, Switzerland, 1999

	Nicotine (mg) written on cigarette packs mean (range)	Tar (mg) written on cigarette packs mean (range)
Regular cigarettes	0.9 (0.3, 1.4)	11.0 (3.0, 15.0)
Mild cigarettes	0.7 (0.5, 0.8)	7.9 (5.0, 9.0)
Light cigarettes	0.5 (0.2, 0.8)	6.3 (2.0, 9.0)
Ultra- or superlight	0.3 (0.1, 0.5)	3.3 (1.0, 5.0)
All packs	0.6 (0.1, 1.4)	6.7 (1.0, 15.0)

rather than a nicotine yield in smoke. High proportions of missing answers to these questions suggest that many people had no opinion on this topic. Similar information on tar numbers was already available to smokers [3,4,24], but this study brings a new insight into the smoker's understanding of nicotine numbers. It is understandable that smokers believe that these numbers indicate a content of nicotine in cigarettes, by analogy with food labels of nutrient content.

According to our data, smokers of regular cigarettes were more dependent than smokers of light and ultralight cigarettes and they smoked more cigarettes per day. Either smokers of regular cigarettes were more dependent because these cigarettes are more addictive or this reflects a selection process whereby more dependent smokers choose regular cigarettes. The latter hypothesis is supported by evidence that some smokers of the lowest yield cigarettes have lower nicotine needs [30]. In addition, smokers of regular cigarettes were older than smokers of mild or light cigarettes, which may also explain why they smoked more cigarettes (each additional year of age was associated with smoking 0.18 more cigarettes per day, $P < 0.001$).

Perceived Risk of Light Cigarettes

A substantial minority of participants (one in four) answered that smokers of light cigarettes were at lower risk of developing lung cancer than smokers of regular cigarettes. This result is congruent with results from United States samples showing that smokers perceived that light and ultralight cigarettes afforded a reduction in risk [3, 24]. Older research showing that lower tar cigarettes were less hazardous may not be applicable to currently available cigarettes because of the increased use of filter ventilation in cigarette design in recent decades and because the standard tar yield difference between low- and high-tar cigarettes no longer exists (i.e., all current regular cigarettes would fall in the lower tar category of mortality studies based on data covering the previous decades) [31–33]. Furthermore, a recent reanalysis of the historic American Cancer Society study found that this study was inconclusive and that it cannot be concluded from this study that smoking lower yield rather than higher yield cigarettes results in harm reduction [20]. In addition, new light cigarettes may introduce new risks through their design, ingredients, or additives [32]. There is a scarcity of research on these new risks. Thus, many smokers misinterpret labels such as "light" and "ultralight" and associate them with a safer and less addictive product. It is likely that nicotine and tar numbers are given an undue credibility and "official status" by the government's requirement of printing these numbers on cigarette packs.

Characteristics of Smokers of Light Cigarettes

Younger smokers preferred mild cigarettes and, as previously found [3], women preferred light and ultralight cigarettes. But there was no statistically significant effect of age and sex on the perceived risk of light cigarettes and on the perceived amount of nicotine delivered by these cigarettes compared to regular cigarettes. Thus, the preference of women and the young for light and mild cigarettes must be explained by other factors. It is possible that this preference is the result of marketing efforts (product diversification to target these groups), that women and the young spontaneously chose brands different from the brands used by adult males, or that women and the young preferred the taste of mild and light cigarettes. A preference for light cigarettes is also a matter of fashion. As light cigarettes have become bestsellers, they are more likely to be smoked because of popularity instead of other reasons. One may wonder whether as many women and young people would smoke if only regular cigarettes were available [34].

Smoking mild, light, and ultralight cigarettes remained associated with the intention to quit smoking and to decrease cigarette consumption, even after adjustment for sex and for the level of dependence. Along with the perception that light cigarettes deliver less nicotine and confer less risk, these results suggest that some smokers use light cigarettes as an alternative to quitting smoking or as a means of reducing the health risks of smoking. Our results are congruent with previous research showing that a significant proportion of smokers believed that switching to lower tar cigarettes decreased the health risks [2,3,26,35]. Industry documents and market studies show that the tobacco industry intended these cigarettes to do just these things [36,37]. This study confirms that current cigarette labeling constitutes misleading and even harmful information. A more meaningful labeling of cigarettes would indicate the nicotine content in tobacco, or the amount of nicotine that smokers actually get from cigarettes, rather than the current machine-determined yields in smoke [8]. Labels should also indicate the content of all chemical additives in cigarettes and the purposes of these additives [8]. Labeling of cigarettes should be meaningful in terms of health and dependence risks, which is not the case today. To avoid a misinterpretation of "light" or "ultralight" labels, these labels should be abandoned and cigarette packs should indicate that there is no evidence that current lower yield cigarettes reduce the risk of cancer, heart attack, stroke, and pulmonary disease compared to that of current regular cigarettes. This strategy can be effective. For example, a campaign advertising against light cigarettes and informing smokers that light cigarettes did not deliver significantly less nicotine increased smoking cessation rates [38]. "Anti-light" messages in-

creased smokers' intention to quit smoking [*39,40*] and increased the likelihood that they would choose a prize consisting of something other than cigarettes [*41*]. The public should be further informed of the real purpose of current cigarette labels.

Limitations of This Study

Swiss laws make it mandatory for manufacturers to write nicotine and tar numbers on all cigarette packs. Because these number do not appear on all cigarette packs in other countries, results from this study may not be comparable with similar data from other countries.

The low response rate may limit the ability to generalize from our results. Because smokers in this survey were slightly more educated than average, our results may provide an optimistic image of knowledge on light cigarettes. Smokers in this survey were more motivated to quit smoking than smokers in the general population. Because motivation to quit was associated with smoking light cigarettes, this survey may slightly overestimate the proportion of smokers of light cigarettes in the population. However, we showed previously that bias in the distribution of variables does not imply bias in associations between variables [*26*]. Thus, the predictors of smoking light cigarettes identified in this study may apply to the general population.

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